STANFORD UNIVERSITY MEDICAL CENTER

DEPARTMENT OF GENETICS

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Dear Dick,

I have never felt that a correspondence needed to be an exact ping pong game with each letter following another's response, so I am sharing some of my current thoughts with you by way of drafting this letter;and, of course, I would be glad to hear from you whenever you wished;but I do not want this to be laying a trip on you.

This has a little more to do with the ideas I was mentioning to you before about looking for the eobionts; and of course it was in that connection that I was hoping that you might be interested to share some of your time with us in a course of a sabbatical.

If we take the hint from the mycoplasmas as being probably the most primitive free-living organisms now recognized, it seems a reasonable proposition that the eobiont might not have a rigid cell wall - like the bacteria, fungi or higher plants. This would be all the more amusing to me since I did dabble once with the L forms of common bacteria and you might be amused to see the enclosed reprint.

If this is the case, the eobiont either requires a hypertonic medium, or a structural matrix externally available, or perhaps both. The idea of the matrix set me to thinking again about carbon. And I am going to enclose another semi-contribution from my own lab - I have to say I did not think the work was quite credible enough to warrant putting my own name on it as well. I also recalled scattered statements to the effect that bacteria adsorbed onto carbon were remarkably heat resistant. Whatever else this says, it suggests that in forms like charcoal there are voids that must be shaped to at least a rough approximation to a niche for a bacterial cell.

Then it dawned on me that the issues about the complexity of the chemical structures;that could be readily formed from carbon by oxidation and other reactions (I mentioned those in connection with the convergence of the problems of water purification on earth with that of the Viking biology on Mars)-may not have been given enough attention in general models about the origin of life. The fact is, as you know, that elemental carbon,whether in the graphite or diamond constitution,already represents an extremely intricate polymeric structure which could be significant to the origin of life in its initial phases in at least two ways: (1) the production of quite complex, especially aromatic, products by simple further manipulations of either reduction or oxidation; and (2) as a seat of highly diverse catalytic activities - of which the Warburg story of iron/charcoal mediated oxidations is the obvious precedent.

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So the phantasy dream, of life emerging as a niche between two plates of carbon hexacycles in graphite, began to take an even more tangible form. This of course is just at the other end of the spectrum from the idea of using carbon as a matrix to permit possibly eobiontic relics to grow, and one does not have to believe in the continuity of those ideas to see something worthwhile at both ends.

The fact is, in our labs here we are already committed to a research program on the chemistry of fragments from activated carbon - from the environmental hazard standpoint - so, there is really no operational jump from this to just thinking about the kinds of products that might be seen from a biopoietic standpoint. Too, I am astonished that much more has not been done long since to follow up on Warburg's observations about the catalysis of biochemical reactions by activated carbons. Now that we have such sensitive methods, it should be quite easy to look for the catalysis of low-level activities in a variety of spheres. I would not exclude the polymerization of ATP and the like as quite reasonable expectations from catalytic centers of this kind.

And then (3) (together with a few other ideas that involve taking seriously what we know of the chemical composition of the primitive earth) to try to fashion habitats for one of the problematical speculations about what more primitive organisms might look like.

Well, these phantasies are just beginning to crystallize to the point where I might want to take them seriously enough to actually start some experiments. Any time you like to join up with any of this, it would be great fun.

Meantime, the one thing that you might be able to do quite conveniently is to let me know whether you have seen any references to the role of carbon along these lines in the bibliographies on biopoiesis that I am sure you nave been accumulating.

I hope you can tolerate this kind of stream-of-consciousness dictation. J.

Sincerely yours,

Joshua Lederberg
Professor of Genetics

* P.S. most of the carbon in chondrites is, of course, graphitic.